Journal of Computational Mathematics, Vol.9, No.3, 1991, 193–197.

HAPPY BIRTHDAY, PROFESSOR FENG KANG!

September 9, 1990 was the 70th birthday of Prof. Feng Kang, outstanding mathematician, Member of Academia Sinica. We four Editorial Committees extend here our warmest congratulations to Professor Feng Kang.

Feng Kang was born in Nanjing, Jiang Su Province. When he was in Suzhou Middle School, he distinguished himself in all his studies and showed strong interest in mathematics and physics. Soon after the War of Resistance had broken out, he left the occupied area for the south. In 1939 he entered the Department of Electrical Engineering, Central University, Chongqing, taking all the required courses for the electrical engineering, physics and mathematics majors, and graduated from Physics Department in 1944, right after that he turned to mathematics. This background played a subtle role in his later career in science.

Since 1945 he had worked in the Departments of Physics and of Mathematics, Fudan University and Tsinghua University. In 1951, joined the newly founded Institute of Mathematics, Academia Sinica, before long, he was sent to Steklov Institute of Mathematics, Academy of Sciences of USSR, for advanced studies. During this period, he had the chance to study under S.S. Chern, L.K. Hua and L.S. Pontrjagin, eminent mathematicians but with different style.

In 1957–1978 Feng worked in Institute of Computing Technology, Academia Sinica. He was elected as a Member of Academia Sinica in 1980. Since 1978 he worked in Academia Sinica Computing Center, Director 1978–1986, Honorary Director 1987–. Chinese Computer Society, Vice Chairman 1978–1986. Chinese Society of Computational Mathematics, President 1985–1990, Honorary President 1990–. Member, Academic Award Commission, State Council, 1980–. He has been associated with various domestic and international universities, scientific institutions, societies and journals. In particular he is deputy editor in chief in Mathematics, Encyclopedia Sinica and editor in chief of the four principal Chinese journals on computational mathematics and scientific computing undersigned below.

Before 1957 Feng devoted to pure mathematics, mainly topological groups and theory of distributions. His earliest works (unpublished) were on generators of symplectic groups and topological proof of the fundamental theorem of quarterion algebra. His main interest is in almost periodic topological groups, initiated by von Neumann in 1934 in relation to unitary representations. Two extreme cases are important: maximal groups with an abundance of unitary representations and minimal groups, devoid of unitary representations. The characterization problem for maximal groups was solved in 1936 by Weil and Freudenthal. The theory for minimal groups was advanced further in 1940 by von Neumann and Wigner, but the characterization problem remained open. In 1950 Feng solved the problem for linear Lie groups, a significant result for representation theory and physical applications.

In theory of distributions, Feng worked out a duality theorem between discrete (delta functions and their derivatives) and continuous distributions. Upon suggestion of L.K. Hua, he founded a theory of generalized Mellin transforms, which has potential applications in partial differential equations and in analytical theory of numbers. His long article presenting the theory of distributions was influential for the development of that new discipline in china.

Since 1957 Feng's research interest turned to applied and computational mathematics, the fields in which Feng's most important contributions lie.

Based on the experience of his collective from late fifties to early sixties on solving large scale engineering computing problems ranging from airfoil flutter dynamics and especially various stress analysis of dams and architectural designs, he originated, independently from the engineering community of Western countries, in a systematic way, the finite element method (or the difference method based on variational principle as was called then) together with its earliest mathematical foundation. This innovation in numerical solution of elliptic equations consists simply in variational principle plus triangulation, putting the discrete solutions together with the continuous ones in the same Sobolev function space—enormous advantages both in practical implementation and in theorectical analysis. It gained rapid developments and world-wide applications. The finite element method now has become classical and is universally recognized as a major progress in contemporary applied mathematics. Feng's merit in the independent origination of the finite element method under the isolated condition then in China was duly appreciated afterwards both at home and abroad.

In 1970's Feng extended the classical theory of elliptic equations to the so-called composite manifolds containing components with different dimensions. This laid a mathematical foundation for complex elastic structures and for the convergence of the correspondent finite element method. This direction is followed and further developed by Feng's students and other researchers in recent years.

It is well known that elliptic equations can be reduced to boundary integral equations. In this aspect Feng originated the so-called natural boundary reduction method, quite different from the conventional Fredholm's approach. He introduced hypersingular kernel (in Hadamard's distribution sense, pseudo-differential operator of order 1) to make the boundary reduction fully compatible with the variational principle over the domain and so to make the boundary finite elements also fully compatible with the domain finite elements. So the resulting integrated methodology (domain finite elements plus boundary elements) is highly flexible and good for large-scale problems with natural and compatible coupling between domains and boundaries. This is in fact a pioneering contribution to the so-called domain decomposition methods now under active development in relation to parallel computation. In particular, he obtained for Helmholtz equation the radiation condition at finite distance corresponding to the classical Sommerfeld radiation condition at infinity, a significant result both in theory and applications. This direction is followed by his students and other researchers, it deserves further exploration.

Since 1984 Feng's interest turned to dynamical problems. At 1984 International Symposium on Differential Geometry and Differential Equations he proposed in a way the Hamiltonian (or symplectic or canonical) algorithms for solving Hamiltonian equations together with mathematical foundation within the framework of symplectic geometry. As is well known, all real physical processes, classical, quantum, relativistic with finite or infinite number of degrees of freedom all included, can always be cast in suitable Hamiltonian form. However, inspite of the importance and ubiquity of Hamiltonian systems, the pertinent numerical methods for such systems were unfortunately and grossly neglected thus far. Works of Feng and his co-worker definitively show the following: (1) All conventional methods are generically non-symplectic, they all inevitably produce artificial dissipation and other kinds of distortions alien to Hamiltonian systems. (2) Infinite varieties of symplectic schemes can be systematically constructed, they are "clean" algorithms, free from all non-Hamiltonian pollutions. (3) The structural properties, including the conservation properties, of the discrete Hamiltonian algorithms are completely parallel to those of the continuous Hamiltonian systems. This ensures the high quality of the algorithms. (4) Computer experimentation confirms convincingly the overwhelming superiority of the symplectic methods over the conventional non-symplectic ones, especially in the aspects of structural, global stability properties and long-time tracking capabilities. Thus Feng's work initiates a new research field of numerical methods for Hamiltonion systems, promising of wide developments and applications.

In addition to his own research, Feng also takes on administrative work. He was an